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ABSTRACT

This autoinstructional program deals with the biological concept of the food making process in plants. No information is listed suggesting previous courses in science or level of achievement required. Behavioral objectives are listed. The script and an accompanying student quiz sheet, as well as a list of materials and equipment needed, are presented. Approximately 15 minutes is required for this lesson. (EB)

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PHOTOSYNTHESIS
PART I

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TEACHER'S GUIDE

PACKET NUMBER	581.133 H
SUBJECT	Biology
TITLE	Photosynthesis Part I
LEVEL	
BEHAVIORAL OBJECTIVES	1. The student must be able to list the materials needed to manufacture glucose in green plants. 2. The student must be able to explain how simple substances such as carbon dioxide and water and radiant energy can be converted into food.
EQUIPMENT	Cassette tape Cassette tape recorder 6 Slides Slide viewer Microscope slide Microscope (compound) A growing healthy plant (coleus, etc.) Teacher's guide Script Student quiz sheet
TIME	Approximately 15 minutes
SPACE REQUIRED	A carrel with electrical outlet

SCRIPT

BIOLOGY
PHOTOSYNTHESIS PART I

In this A-T session you should learn something about the process of photosynthesis which is the production of food by green plants. The concept I would like to establish here is that food, all food, that provides energy for most of the living organisms is produced by green plants. Most of the material, for growth and reproduction comes directly or indirectly from green plants that carry on photosynthesis. You should, by completing this A-T be able to explain how green plants can manufacture or the basic process of photosynthesis.

One of the simplest types of food is glucose. This is the type usually manufactured by green plants. Green plants tend to manufacture this in excess of their own needs, other organisms such as non-green plants and animals use this simple sugar, glucose, or some other more complex molecule made from glucose as food. The important aspect of this is that green plants can store light energy in molecules as chemical energy. Photosynthesis is very important because almost all living things utilize chemical energy directly or indirectly for life. Most all of the processes that take place in living things require energy and this energy originally came from the sun by way of [illegible]tosynthesis.

I shall attempt to explain very briefly photosynthesis by using these slides, diagrams, and models you see in the carrel in front of you. You should first of all notice the green plant in front of you. Notice how the leaves are arranged to efficiently gather light energy. They

are spread out so that none really prevent the light from reaching the surface of others. If we were to examine a part of one of these leaves such as a cross section as illustrated by SLIDE #1. Please turn on the slide projector and view SLIDE #1. You can see the cells are arranged in a very definite pattern and they contain some small green structures in almost every cell. Also look at the prepared microscope slide that is on the stage of the microscope. This is also a cross section of a green leaf. You may turn off the tape recorder until you have had a chance to view this slide. PAUSE. Of course you could not see these small structures unless they were magnified by a microscope lens. Now view SLIDE #2. This is a picture of a portion of a leaf cell showing these structures, called chloroplasts in more detail. This cell has been enlarged many times. However, with this magnification you still cannot see where the action is in this chloroplast. Look very carefully at the slide again. Do you notice what appear to be green colored "stacks" inside the chloroplasts? Now view SLIDE #3. SLIDE #3 shows how the green colored stacks you observed in SLIDE # 2 are probably arranged. These so-called stacks have been named grana by scientists. The grana are made up of chlorophyll and protein molecules plus some other substances that absorb the radiant energy from the sun and pass it along to be stored as chemical energy in a molecule of food such as glucose. A very simple chemical equation is often used to illustrate how a molecule of glucose is made. Now look at SLIDE #4. Notice the simple raw

materials needed to make a molecule of glucose. A general summary of the equation is that carbon dioxide plus water are combined by the plant to form glucose ($C_6H_{12}O_6$) plus oxygen. During this process the energy which once came from the sun is now locked up as chemical energy in the glucose molecule. The chemistry involved in actually producing glucose is much more complex and some steps are not completely understood. However, the major reactions have been worked out and have been demonstrated.

In this A-T the important objective is that you understand that food is made fom simple molecules as illustrated by SLIDE #5. Please view SLIDE #5. If you took the time to count the number of beads of each color on each side of the equation you would find them to be equal. Remember that the photosynthesis process is taking raw materials from simpler substances and rebuilding them into other substances that are needed. These simple molecules are arranged in such a way that the larger molecule, glucose, that you see on the right will contain the energy used to put it together. The chemical energy which enables the small molecules to join together to form the molecule of glucose was converted from light energy by the grana in the chloroplast. The ability to convert light energy into chemical energy is extremely important since all living things depend upon having chemical energy available to them. The green plant with its chlorophyll contained in its grana is unique in absorbing radiant energy and changing it into chemical energy to make food. Please view SLIDE #6 now. Note the

hydrogen from the water molecule is then transferred to the carbon dioxide containing molecules in such a way that a glucose molecule is eventually made. In simple terms the process of adding the hydrogen to the carbon requires energy. When the hydrogen is finally joined to the carbon, then the energy used to put it there is stored in the newly formed molecule. In this case it is glucose, a relatively simple but a very important molecule. If you feel you now can give a satisfactory explanation of photosynthesis, then this A-T has accomplished what it was intended to do. If you feel you do not understand this concept, then you may wish to run through the A-T again. Try to answer the questions on the evaluation quiz before leaving the carrel. Turn the tape back on for the answers when you have finished taking the quiz.

MUSIC

Here are the answers to the quiz.

1. The raw materials plants use for making food are:
   (c) carbon dioxide and water.
2. Plants are sometimes said to be unique because they can
   (b) convert radiant energy into chemical energy.
3. One of the following statements is <u>not</u> true: (d) green plants only manufacture enough glucose for their own needs. This is false since they must provide the animals with their glucose also.
4. Which of these statements is incorrect? (d) All living organisms can convert radiant energy into chemical energy. Animals and non-green plants cannot.

5. In the process of making glucose, water molecules are split and hydrogen is: combined with carbon dioxide.

6. The most important concept to remember about photosynthesis is:
(d) green plants can convert radiant energy into chemical energy in excess of their own needs.

You may wish to give this sheet to your instructor or ask for additional information before you leave this topic. If you have completed your work on this A-T, then please rewind the tape on the tape recorder and place the slides in the proper sequence before you leave and make sure the power is turned off. Thank you.

STUDENT QUIZ SHEET

Photosynthesis - Part I

_____1. The raw materials plants use for making food are:

a. water and oxygen
b. water and hydrogen
c. carbon dioxide and water
d. carbon dioxide and glucose

_____2. Plants are sometimes said to be unique because they can:

a. produce oxygen
b. convert radiant energy into chemical energy
c. convert chemical energy into radiant energy
d. change molecules

_____3. One of the following statements is <u>not</u> true:

a. glucose is a relatively simple molecule
b. glucose is a very widely used food substance
c. glucose is made from carbon dioxide and water
d. green plants only manufacture enough glucose for their own needs.

_____4. Which of these statements is incorrect:

a. plant cells that contain chloroplasts can manufacture glucose

b. plant cells that contain chloroplasts can trap radiant energy.

c. plant cells that contain chloroplasts can convert radiant energy into chemical energy

d. all living organisms can convert radiant energy into chemical energy

_____5. In the process of making glucose, water molecules are split and hydrogen is:

a. combined with oxygen
b. combined with carbon dioxide
c. combined with glucose
d. combined with water

_____6. The most important concept to remember about photosynthesis is:

a. plants need energy
b. animals need energy
c. green plants can convert radiant energy into chemical energy
d. green plants can convert radiant energy into chemical energy in excess of their own needs.